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Guided Surgery in Dentistry with a Focus on Advances and Clinical Applications

Guided Surgery In Dentistry With A Focus On Advances And Clinical Applications

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Summary

Guided surgery in dentistry represents a significant advancement in the integration of digital technologies and clinical practice, providing greater precision, predictability, and safety in surgical procedures. Based on the use of cone-beam computed tomography, three-dimensional scans, virtual planning software, and additive manufacturing, this approach allows for the faithful transfer of digital planning to clinical reality through surgical guides. The literature reviewed shows the expansion of applications of guided surgery in areas such as implantology, endodontics, and periodontics, with superior aesthetic and functional results when compared to conventional techniques, especially in more complex cases.

Despite the observed benefits, challenges related to implementation costs, the learning curve, and the need for standardization of protocols still hinder its widespread and routine adoption. Furthermore, ethical aspects, such as informed consent and the proper management of patient expectations, assume a central role in the face of the increasing incorporation of digital technologies. In conclusion, guided surgery is consolidating itself as a promising practice in contemporary dentistry, provided it is applied judiciously, ethically, and based on rigorous planning and continuous professional training.

Keywords: Guided surgery; Digital planning; Computed tomography; 3D printing; Cosmetic dentistry.

Abstract

Guided surgery in dentistry represents a significant advancement in the integration of digital technologies into clinical practice, providing greater precision, predictability, and safety in surgical procedures. Based on the use of cone-beam computed tomography (CBCT), three-dimensional scanning, virtual planning software, and additive manufacturing, this approach allows for the precise transfer of digital planning to the clinical environment through surgical guides. The literature reviewed demonstrates an expansion of guided surgical applications in areas such as implantology, endodontics, and periodontics, with superior aesthetic and functional results compared to conventional techniques, particularly in more complex clinical situations. Despite the observed benefits, challenges related to implementation costs, the learning curve, and the need for standardization of protocols still limit its widespread adoption. Furthermore, ethical aspects, including informed consent and the proper management of patient expectations, play a central role in the context of the increasing use of digital technologies. It is concluded that guided surgery is becoming established as a promising practice in contemporary dentistry, provided it is applied carefully and ethically, and supported by rigorous planning and continuous professional training.
Keywords: Guided surgery; Digital planning; Cone beam computed tomography; 3D printing; Aesthetic dentistry.

INTRODUCTION

Guided surgery in cosmetic dentistry, applied using three-dimensional images,

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It constitutes one of the most relevant tools for improving aesthetic results.
functional aspects in contemporary clinical practice. The integration between computed tomography,
three-dimensional imaging resources, surgical planning systems, and prototyping processes
It enables the creation of surgical guides capable of accurately transferring virtual planning.
for the patient's oral cavity, allowing for interventions with greater predictability and safety.

The planning is carried out at all stages of treatment, with the support of technology.
Three-dimensional imaging directly assists the dentist in making clinical decisions, reducing the risk of accidents.
The occurrence of intra- and post-operative complications contributes to achieving aesthetic results.
more satisfactory. Scientific literature demonstrates that technological advancement expands the possibilities.
therapeutics in areas such as implantology, endodontics and periodontics, with functional outcomes and
Superior aesthetic results when compared to conventional techniques.

The guided surgery technique is based on the use of three-dimensional images to...
preoperative planning and subsequent fabrication of a surgical guide, which directs the
The operator is improved during the procedure, increasing the precision and safety of the intervention.
use of cone beam computed tomography, digital scans, software of
Three-dimensional planning and printing allows for the faithful transfer of the virtual plan.
for clinical practice, reducing risks and increasing the predictability of treatments.

Despite the high costs and learning curve associated with computational techniques,
The benefits of guided surgery are encouraging a growing number of professionals to specialize in it.
with a view to improving clinical outcomes and meeting contemporary demands of
patients. In addition to the technical aspects, the incorporation of digital technologies imposes on the surgeon-
dentist ethical responsibilities related to informed consent, transparency regarding
Technical limitations and the proper management of patient expectations.

Given this scenario, this article, based exclusively on the final project of
The course that gave rise to it aims to critically analyze guided surgery in cosmetic dentistry.
systematizing its conceptual foundations, technical evolution, clinical applications, advantages,
limitations and trends, with an emphasis on predictability, security, and digital integration in
planning and executing the procedures.

THEORETICAL FOUNDATION

Evolution and concept of guided surgery in Dentistry

Guided surgery in dentistry emerges as a direct consequence of the evolution of methods.
of diagnostic imaging and the incorporation of digital technologies into clinical planning. A

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possibility of integrating data from computed tomography with scans
Digital and three-dimensional planning software allowed for greater control over position.
depth and angulation of surgical procedures, reducing exclusive dependence on
The operator's empirical experience.

The concept of guided surgery is based on the faithful transfer of virtual planning to the...
The operating field is created using surgical guides made from digital models. These
The guides function as physical orientation devices, limiting the action of the surgical instruments.
to the positions previously defined in the virtual environment. In this way, the procedure becomes
Executed in a more predictable manner, with less room for deviations related to interpretation.
Subjective clinical practice.

The development of cone-beam computed tomography was crucial for...
Consolidation of guided surgery in dental practice. Obtaining three-dimensional images.
Precise measurements allowed for detailed analysis of bone structures, their relationship to adjacent teeth, and...
Sensitive anatomical structures, allowing for safer and more individualized treatment planning. A
Based on this information, it became feasible to virtually simulate the surgical procedure beforehand.
its clinical execution.

Initially associated primarily with implant dentistry, guided surgery has expanded its applications.
applications for other areas of Dentistry, such as periodontal and endodontic procedures and
surgical procedures in aesthetic areas. This expansion occurred due to greater predictability.
provided by digital planning and the ability to accurately reproduce what was
previously defined in a virtual environment.

However, the effectiveness of guided surgery is directly related to the quality of the
The steps that precede it. The accuracy of the tomographic images, the correct integration between the files.
Digital technology and precision in the manufacture of surgical guides are key factors for the success of...
procedure. Thus, guided surgery should be understood as part of a workflow.
integrated, in which each step directly influences the final result.

Technologies applied to guided surgery

The application of guided surgery in dentistry depends directly on the integration between
different digital technologies, which work in a complementary way throughout the workflow.
Among these technologies are cone beam computed tomography and planning software.
Virtual and additive manufacturing systems play a central role in predictability and safety.
of the procedures.

Cone beam computed tomography forms the diagnostic basis for treatment planning.

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guided, allowing the acquisition of high-definition three-dimensional images of bone structures and anatomical. The possibility of analyzing axial, coronal, and sagittal sections, as well as reconstructions. volumetric measurements facilitate the precise identification of anatomical boundaries and available bone thickness. Critical spatial relationships are fundamental aspects for defining surgical planning.

Virtual planning software enables the integration of tomographic data with Digital scans of the dental arch. This combination allows for prior simulation of... procedure, with precise virtual positioning and analysis of individual anatomical conditions of The digital environment offers greater control over surgical variables, reducing uncertainties. and facilitating clinical decision-making prior to intervention.

Based on virtual planning, additive manufacturing, through 3D printing, makes it possible to... The fabrication of surgical guides used during the procedure. These guides are designed to... adapt to the patient's dental, mucosal, or bone structures, transferring the... Digital planning for the operating field. Stability, proper fit, and fidelity. The dimensions of the guide are determining factors for the effectiveness of guided surgery.

The association between computed tomography, virtual planning and 3D printing. It characterizes guided surgery as an integrated process, in which each step depends on the quality. from the previous one. In this way, the predictability achieved does not result from an isolated technology, but from... Correct articulation between diagnostic imaging, digital planning, and guided clinical execution.

Advantages and Challenges of Guided Surgery in Dental Practice

Guided surgery offers significant clinical advantages by allowing for greater precision and Predictability in surgical procedures. The transfer of virtual planning to the field. The operational approach reduces the possibility of deviations during execution, contributing to greater safety. especially in sensitive anatomical regions. This predictability favors the reduction of It prevents complications, improves control of the depth and angle of the instruments, and enables... more conservative procedures.

Another benefit associated with guided surgery is the optimization of clinical time. Planning A detailed preliminary study tends to make the procedure more objective, with less need for adjustments. intraoperative procedures. Furthermore, standardizing the steps contributes to greater organization of the workflow. clinical and for a more predictable experience for both the professional and the patient.

From the patient's point of view, guided surgery can provide greater comfort and confidence. since more precise procedures tend to be less invasive. The possibility of Demonstrating the plan beforehand also promotes communication and understanding of... proposed treatment, strengthening the professional-patient relationship.

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However, the adoption of guided surgery involves challenges that must be considered. Costs related to the acquisition of equipment, software, and the production of surgical guides may... to limit its implementation, especially in certain clinical contexts. Furthermore, the curve Learning associated with the use of digital technologies requires adequate training and updating. professional consistency.

Another relevant aspect concerns the dependence on the quality of digital information. Failures in the acquisition of tomographic images, in the integration of files, or in the preparation of the guide. They can compromise the accuracy of the procedure. Therefore, guided surgery does not eliminate risks. but shifts attention to the planning stage, making rigorous control of each essential. workflow phase.

When correctly indicated and performed, guided surgery represents a valuable tool. Effective in increasing clinical predictability. However, its success is directly related to the careful evaluation of the advantages and limitations, as well as the technical skills of the professional. involved.

Comparison between guided surgery and conventional techniques.

A comparison between guided surgery and conventional techniques reveals differences. significant in the way surgical procedures are planned and executed. conducted. In conventional approaches, the professional relies primarily on interpretation. two-dimensional radiographic examinations and clinical experience are used to determine positioning. Angle and depth during surgery. This model is subject to greater variability. operative procedures and limitations related to the visualization of anatomical structures.

In guided surgery, planning takes place beforehand in a digital environment, based on... Three-dimensional images obtained by computed tomography and integrated with scans. digital. This step allows for a detailed simulation of the procedure, reducing the need for Intraoperative decisions and increased control over surgical variables. The use of guides Surgical procedures allow for the faithful reproduction of virtual planning, promoting greater predictability.

From a precision standpoint, guided surgery tends to offer advantages, especially in situations of greater anatomical complexity or in regions with sensitive structures. The limitation The physics imposed by the guide contributes to the reduction of deviations, while in conventional techniques the Precision is directly related to the operator's manual skill and experience.

However, conventional techniques still retain clinical relevance, especially in cases... simpler situations or in contexts where access to digital technologies is limited. Furthermore, the The intraoperative flexibility characteristic of traditional approaches can be advantageous in

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Unforeseen situations in which immediate adjustments are necessary.

Therefore, guided surgery and conventional techniques should not be understood as
These approaches are mutually exclusive, but complementary methods. The choice between one or the other should...
always consider the complexity of the case, the resources available, and the professional's capabilities.
with a focus on the safety and predictability of treatment.

Ethical Aspects of Guided Surgery in Dentistry

The incorporation of guided surgery into dental practice brings ethical implications that must be considered.
to be carefully considered by the professional. The use of advanced digital technologies
It can convey to the patient the perception of risk-free procedures, which makes it indispensable.
Clear and realistic communication about the possibilities, limitations, and potential unforeseen events.
associated with treatment.

Informed consent plays a central role in this context. The patient must be
properly informed about the steps of digital planning, the use of tomographic exams, the
The preparation of surgical guides and the nature of the proposed procedure. The presentation of
Virtual planning can facilitate understanding of treatment, provided it is accompanied by
Accurate and ethical information, avoiding the creation of unrealistic expectations regarding the results.

Another relevant ethical aspect concerns professional responsibility. Although surgery
While guided technology offers greater predictability, it does not replace clinical judgment or the...
The technical responsibility lies with the dentist. It is up to the professional to assess the correct indication for...
Technically, ensure the quality of the digital information used and take full responsibility for the decisions.
clinics involved in the procedure.

The growing dependence on digital technologies also demands attention to the correct
Use of available resources. Inappropriate use of images, flaws in planning or in
The creation of these guidelines can compromise clinical outcomes and generate ethical and legal implications.
In this way, continuous professional development and mastery of digital tools become essential elements.
essential for responsible practice.

Therefore, guided surgery should be applied within ethical principles that prioritize the
Patient safety, transparency in communication, and professional responsibility. A
Technology, when used judiciously, acts as a resource to support decision-making.
clinical practice, reinforcing the need for a dental practice grounded in both knowledge
Technical expertise as well as professional ethics.

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CONCLUSION

Guided surgery has become a relevant approach in dentistry.
contemporary integration of diagnostic imaging, digital planning, and clinical execution.
more predictable and safer. The use of cone beam computed tomography, combined with
Virtual planning software and the production of surgical guides through additive manufacturing make possible
Greater control of surgical variables contributes to reducing uncertainties during the procedure.
procedures.

The observed benefits include greater accuracy, better predictability of results and...
Optimization of clinical time, especially in cases of greater anatomical complexity. A
possibility of prior simulation and faithful transfer of the planning to the operating field.
This represents a significant advancement over conventional techniques, expanding the possibilities.
therapeutics and the safety of treatments.

However, the effectiveness of guided surgery is directly dependent on the quality of each [successor/procedure].
Digital workflow stage. Failures in image acquisition, file integration, or in...
The way the guides are created can compromise the results, highlighting that technology, by itself, is not...
eliminates risks. Furthermore, factors such as implementation costs, learning curve, and...
The need for continuous training should be considered when adopting this approach.

From an ethical standpoint, the application of guided surgery demands professional responsibility.
Transparent communication and adequate informed consent. Technology must be understood.
as a tool to support clinical decision-making, and not as a substitute for knowledge,
based on the experience and judgment of the dental surgeon.

Therefore, it can be concluded that guided surgery represents an important evolution in practice.
In dentistry, it can be used judiciously, ethically, and integrated into a rigorous treatment plan.
Your success depends on the balance between technology, professional training, and responsibility.
Clinically, this ensures predictable results aligned with the individual needs of each patient.

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